

## List of Contents

### NUMBER 1

#### *SPECIAL ISSUE*

#### **UTILIZATION OF SOLAR SYSTEM RESOURCES**

*A selection of papers presented at the  
39th Congress of the International Astronautical Federation,  
Bangalore, India, 10-14 October 1988*

##### **Foreword**

Richard Boudreault 1

#### **PART 1. ECONOMIC VIABILITY**

##### **A strategy for investment in space resource utilization**

Wendell W. Mendell 3

##### **Lunar resources: evaluation and development for use in a lunar base program**

J. D. Burke 11

##### **Putting space resources to work**

Eric M. Jones 15

#### **PART 2. RESOURCES PROCESSING**

##### **An analysis of possible advanced space strategies featuring the role of space resource utilization**

Bruce Cordell and Otto Steinbronn 19

##### **Technical strategies for lunar manufacturing**

Tsutomu Iwata 29

##### **International manned missions to Mars and the resources of Phobos and Deimos**

Brian O'Leary 37

#### **PART 3. TECHNOLOGY ASPECTS**

##### **Economical *in situ* processing for orbital debris removal**

Kumar Ramohalli 55

##### **Techniques for the utilization of extraterrestrial resources**

Leon B. Weaver and Eric Laursen 61

### NUMBER 2

##### **Three-dimensional dynamics and control of tether-connected *N*-body systems**

A. K. Misra and V. J. Modi 77

##### **Probability density functions of vegetation indices**

Toni K. Yanev 85

<b>Exploration Technology Program plans and directions</b>		
A. Aldrich, R. Rosen, M. Craig and J. C. Mankins		93
<b>Relativistic interstellar flight communication theorems</b>		
	Claudio Maccone	105
<b>Time and mass perception in non-terrestrial environments</b>		
	W. Albery and D. Repperger	119
<b>ACADEMY TRANSACTIONS NOTES</b>		
<b>Cloud height estimation using the visible images from two geosynchronous satellites</b>		
	Y. J. Chong and P. S. Toh	127
<b>Pulsar-aided SETI within a hundred light years</b>		
	Jean Heidmann	129
<b>Tonic vibration reflexes and background force level</b>		
	James R. Lackner, Paul DiZio and John Fisk	133

## NUMBER 3/4

### SPECIAL ISSUE

#### SETI-3: THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE

*A selection of papers from 1987-1990 Symposia of the International Academy of Astronautics held during the 38th-41st Congress (Brighton, Bangalore, Malaga, Dresden) of the International Astronautical Federation*

<b>Introduction</b>		
	J. Heidmann	139
<b>PEŠEK LECTURE</b>		
<b>An introduction to the first Rudolf Pešek SETI Lecture</b>		
	Luboš Perek	141
<b>Reflections on the modern history of SETI</b>		
	Frank D. Drake	143
<b>BIOASTRONOMICAL CONTEXT</b>		
<b>Spectroscopic searches for low-mass companions of stars</b>		
	David W. Latham, Robert P. Stefanik and Tsvi Mazeh	145
<b>The Moon and SETI</b>		
	Jerome Pearson	151
<b>Recent advances in chemical evolution and the origins of life</b>		
	John Oro and Antonio Lazcano	157
<b>TECHNOLOGY</b>		
<b>The MCSA 2.1: a fully digital real-time spectrum analyzer developed for NASA's SETI Project</b>		
	J. F. Duluk Jr, A. Jeday, M. Massing, Chih-Kang Chen and Huy Nguyen	159

<b>Real time data acquisition in SETI</b>	<b>P. R. Backus, J. C. Jordan and D. G. Harper</b>	<b>169</b>
<b>SETI field tests with the MCSA 1.0 prototype and plans for radio astronomical observations</b>	<b>Jill Tarter</b>	<b>173</b>
<b>Status of the NASA SETI Sky Survey microwave observing project</b>		
M. J. Klein, S. Gulkis, H. C. Wilck, E. T. Olsen, M. F. Garyantes, D. J. Burns, P. R. Asmar, R. B. Brady, W. T. S. Deich and N. A. Renzetti		<b>177</b>
<b>Detection of the Earth with the SETI microwave observing system assumed to be operating out in the galaxy</b>	<b>John Billingham and Jill Tarter</b>	<b>185</b>
<b>SEARCHES</b>		
<b>The SERENDIP piggyback SETI project</b>		
M. Lampton, S. Bowyer, D. Werthimer, C. Donnelly and W. Herrick		<b>189</b>
<b>High resolution SETI: experiences and prospects</b>	<b>Paul Horowitz and Ken Clubok</b>	<b>193</b>
<b>Conclusion of the selected target search at the Nançay Observatory</b>		
François Biraud and Jill Tarter		<b>201</b>
<b>Pulsar-aided SETI experimental observations</b>		
J. Heidmann, F. Biraud and J. Tarter		<b>205</b>
<b>SETI observational program in Argentina</b>		
F. Raúl Colomb, M. Cristina Martín and Guillermo A. Lemarchand		<b>211</b>
<b>RADIOFREQUENCY INTERFERENCES</b>		
<b>SETI and the radiospectrum</b>		
H. C. Kahlmann		<b>213</b>
<b>A strategy for SETI observations at Arecibo Observatory</b>		
W. J. Welch		<b>219</b>
<b>Rejection of RFI by means of interferometry</b>		
J. W. Dreher		<b>223</b>
<b>An assessment of the impact of radiofrequency interference on microwave SETI searches</b>		
M. J. Klein, S. Gulkis, E. T. Olsen, E. F. Armstrong and E. B. Jackson		<b>227</b>
<b>Summary of interference measurements at selected radio observatories</b>		
Jill Tarter		<b>233</b>
<b>POSSIBILITIES</b>		
<b>Giant Metrewave Radio Telescope—its possible use for SETI</b>		
Govind Swarup		<b>239</b>
<b>Suggestions for a large southern radio telescope</b>		
Sebastian von Hoerner		<b>243</b>

**The gravitational lens as an intergalactic communication tool**

Nathan Cohen 249

**INTERDISCIPLINARY CONNECTIONS****Analogy between Olbers' Paradox and the Fermi Paradox**

Iván Almár 253

**Nonconscious intelligence in the Universe**

David M. Raup 257

**SETI and the two terrestrial cultures**

Ben Finney 263

**Languages based on science**

Carl L. De Vito 267

**Efficiently coded messages can transmit the information content of a human across interstellar space**

William A. Reupke 273

**PUBLIC RELATIONS****ETI, SETI and today's public opinion**

Roberto Pinotti 277

**SETI and the media: views from inside and out**

Donald E. Tarter 281

**An international agreement concerning the detection of extraterrestrial intelligence**

Michael A. G. Michaud 291

**A reply from Earth?**

Michael A. G. Michaud, John Billingham and Jill Tarter 295

**NUMBER 5****Satellite attitude control in the equivalent axis frame**

Theresa W. Long 299

**Reactionless orbital propulsion using tether deployment**

Geoffrey A. Landis 307

**Thrust control of hydrazine rocket motors by means of pulse width modulation**

Hanan Rom and Alon Gany 313

**Supersonic flow past pointed-nose thin airfoils**

Hamdi T. Hemdan and Abdulfatah A. Selim 317

**Phenomenology of a water venting in low earth orbit**

I. L. Kofsky, D. L. A. Rall, M. A. Maris, N. H. Tran, E. Murad, C. P. Pike, D. J. Knecht, R. A. Viereck, A. T. Stair Jr and A. Setayesh 325

**An application study of transportable reactor to lunar base power system**

K. Haga, M. Kambe, H. Kataoka, N. Ohtani and A. Otsubo 349

## **NUMBER 6**

### **ACADEMY TRANSACTIONS NOTE**

## **NUMBER 7**

### **SPECIAL ISSUE**

#### **SPACE DEBRIS**

*Selected papers presented at the 42nd Congress of the International Astronautical Federation,  
Montreal, Canada, 5–11 October 1991*

**Examination of possible collisions in space**

Darren Scott McKnight 497

**Determining the effects of space debris impacts on spacecraft structures**William J. Tedeschi, Cdr John C. Connell, Darren S. McKnight, Firooz Allahdadi,  
Captain Al Reinhardt, Ronald D. Hunt and David M. Hogg 501**Quantifying the orbital debris environment**

Phan Dao, R. McNutt, F. M. Jonas, P. Soliz and K. W. Yates 513

**Breakup in geostationary orbit: a possible creation of a debris ring**

Tetsuo Yasaka and Nobuaki Ishii 523

**The effects of chemical propulsion on the environment**

R. R. Bennett, J. C. Hinshaw and M. W. Barnes 531

**NUMBER 8-10*****SPECIAL ISSUE*****THE NEXT CENTURY: PROSPECTS FOR SPACE**

*Selected papers presented at the  
42nd Congress of the International Astronautical Federation  
Montreal, Canada, 7-11 October 1991*

**Preface**

Rodolfo Monti xi

**I. THE TECHNOLOGIES****I. 1. Space Systems****In-orbit demonstration of novel solid state micro-accelerometers**

Gerhard Kulzer, Yves de Coulon, Philippe Roussel and Manfred Trischberger 543

**Telescience with MARCO/HOLOP on board the Spacelab D2-mission as a preparation for Columbus**

E. Bennett, W. Geist, K. Heimann, D. Heyland, G. Hirsch and K. D. Schmidt 551

**Telemaxus: a telescience oriented sounding rocket experiment**

R. Monti, R. Fortezza, G. Desiderio, G. Capuano and D. Titomanlio 563

**I. 2. Astrodynamics****Closed loop reentry guidance law of a space plane: application to Hermes**

F. Jouhaud 577

**Optimal trajectories for a multiple rendezvous mission to asteroids**

R. Bulirsch and R. Callies 587

**SeGRAM: a practical and versatile tool for spacecraft trajectory optimization**

B. H. Rishikof, B. R. McCormick, R. E. Pritchard and S. J. Sponaugle 599

**Dynamical analysis of the deployable wire and probe antenna systems aboard the dual-spin satellite GEOTAIL**

Y. Morita, M. Hinada, A. Kitsui and Y. Takemoto 611

**II. THE SYSTEM**

*II. 1. Space Transportation*

**Flying qualities of the Hermes spaceplane and shape definition process**

E. Raillon, P. Parnis and N. Devaux 621

**Rocket-powered single-stage-to-orbit vehicles for safe economical access to low Earth orbit**

D. G. Andrews, E. E. Davis and E. L. Bangsund 633

*II. 2. Space Propulsion*

**Applications of magnetic sails**

S. G. Love and D. G. Andrews 643

*II. 3. Space Power*

**Orbit demonstration of two-dimensional deployable array including high voltage photovoltaic power generation**

Hitoshi Kuninaka, Michihiro Natori, Yoshiharu Kawai and Shingo Ikegami 653

**III. THE EXPLOITATION**

*III. 1. Earth Observation*

**Vegetation index of a mixed class of natural formations**

Dimitar Mishev 665

*III. 2. Materials and Structures*

**An approach to dynamics of flexible orbiting systems with application to the proposed Space Station**

V. J. Modi and A. Suleman 669

*III. 3. Microgravity Sciences and Processes*

**Computer simulation of oscillatory Marangoni flow**

M. Ohnishi, H. Azuma and T. Doi 685

*III. 4. Space Exploration*

**Mars balloon simulator**

A. Vargas, C. Tarrieu, J.-P. Lepage, P. Mauroy and C. Sirmain 697

*III. 5. Satellite Communications*

**ESA Dual-Standards S-band Transponder: a versatile TT&C equipment for communications via a Data Relay Satellite or directly with the ground network**

J. L. Gerner 707

**System and technological aspects for EHF satellite cellular communications**

G. E. Corazza, F. Valdoni, F. Vatalaro and M. Ruggieri 715

*III. 6. Space and Education*

**The situation of space education in the unified Germany**

Hans H. von Muldau 723

*III. 7. Space Sciences*

**QuickStar: rapid access to space for small scientific payloads**

T. P. Garrison and S. R. Schrock 729

#### IV. HISTORY OF ASTRONAUTICS

##### **The Navaho cruise missile—a burst of technology**

Dale D. Myers 741

#### NUMBER 11

##### **Dynamics of the orbiter-based WISP experiment**

V. J. Modi and A. M. Ibrahim 749

##### **Minimum-time aerobraking maneuver at constant altitude**

Jeng-Shing Chern, Ching-Yew Yang and Chung-Chen Lai 763

##### **Time-optimal geomagnetic attitude maneuvers of an axisymmetric spinning satellite**

V. O. Gamarra Rosado and A. Rios Neto 773

##### **Mathematical modelling of the unified bipropellant propulsion system**

V. Shankar, K. Anantha Ram and A. E. Muthunayagam 779

##### **Aluminum 2219-T87 and 5456-H116: a comparative study of spacecraft wall materials in dual-wall structures under hypervelocity impact**

William P. Schonberg 799

##### **Advanced Communications Technology Satellite (ACTS)**

Richard T. Gedney, David L. Wright, Joseph L. Balobin, Philip Y. Sohn,  
William F. Cashman and Alan L. Stern 813

##### **Faint object camera: European contribution to the Hubble Space Telescope**

H. W. Kröger, G. K. Schmidt and N. Pailer 827

##### **A satellite based global education system: the Knowledge Network of the World**

Joseph N. Pelton 835

##### ***EX MUNDO ASTRONAUTICO***

##### **In Memoriam—Dean C. A. Colliard**

Michel Bourely 841

##### **In Memoriam—Josip Kotnik**

Harry O. Ruppe 841

##### **IAA Membership**

843

#### NUMBER 12

##### **General solution for the optimal trajectory of an AFE-type spacecraft**

A. Miele and T. Wang 855

##### **Low cost orbit transfer of inoperative satellites by a service vehicle**

Tetsuo Yasaka 867

##### **A new facility for fluid sciences: the Liquid Structure Facility**

J. C. Legros, O. Dupont, P. Holbrouck, P. Verhaert and G. Bekaert 875

<b>Design, performance, and experiment capabilities of the AGHF: ESA's advanced gradient furnace for Spacelab</b>	<b>W. Biemann and J. Terracol</b>	<b>881</b>
<b>Potential evolution of an International Moon Base Programme</b>	<b>P. J. Conchie, C. M. Hemsell and R. C. Parkinson</b>	<b>889</b>
<b>Mars Direct: humans to the Red Planet by 1999</b>	<b>Robert M. Zubrin and David A. Baker</b>	<b>899</b>
<b><i>EX MUNDO ASTRONAUTICO</i></b>		
<b>In Memoriam—Victor Ivanovich Kuznetsov</b>	<b>V. I. Reshetnikov</b>	<b>913</b>
<b>In Memoriam—Sergey Aramovitch Sarkisyan</b>	<b>S. S. Korunov</b>	<b>913</b>

